Saskatchewan Watershed Authority

Control of Knapweeds in Native Grasslands

Russian Knapweed

INVASIVE species

Introduction

Knapweeds *(Centaurea spp)*, a family of highly competitive weeds, has long been a threat to many of the native rangelands in the United States and interior British Columbia. They have made their way into parts of Alberta and Saskatchewan and could possibly further their expansion if precautions are not taken.

Knapweed was introduced into North America in the late 1800's, most likely as a contaminant in alfalfa or grass seed. This highly aggressive weed has now infected approximately 40 470 hectares (100,000 acres) of native rangeland in interior British Columbia and could potentially spread to affect 1 million hectares (2.7 million acres) in the future. It has been reported in Alberta to occupy about 145 different sites of which the size is not known.

Knapweed is most commonly found in areas of disturbance. It makes its habitat on light textured soils where competition is minimal. It is easily transported through vehicles, machinery, trains, hay, wind, animals (some birds and rodents eat the seeds), and florists (some have used it in dried floral arrangements).

Knapweed is a problem that cannot be ignored. If control and preventive measures are not taken, this weed could creep its way into our native grasslands, becoming a large threat to biodiversity.

Plant Identification

The most commonly known types of knapweed are:

Centaurea repens
(Russian Knapweed)

Russian knapweed is a herbaceous perennial that reproduces by both seed and vegetative root buds. It has erect stems that grow to be 46-91 cm (18-36 inches) tall and the entire plant is covered with dense hairs giving it a grey-green appearance. Leaves are similar in shape to Canada thistle and become smaller and fewer lobed towards the top of the plant. Russian knapweed emerges early in the season, and flowers throughout the summer. The flowers grow solitary at the tip of the stem, are cone-shaped, and are pink, lavender, or white in color. As the plant matures, the flowers take on a straw-coloured appearance. The seeds are ivory in color and have small white bristles that detach easily at maturity, allowing for easy dispersal by wind. Roots are vertical and horizontal with a black-brown scaly appearance and can grow to a depth of more than 6 meters (20 feet). Root density can reach up to 2.5 roots per square meter (27 roots per square foot) thereby allowing it to completely dominate the surrounding vegetation. These rapidly expanding roots can cover up to 10 square meters (12 square yards) in two growing seasons. A Saskatchewan stand of Russian knapweed has been documented to

sheet

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invasive species fact sheet

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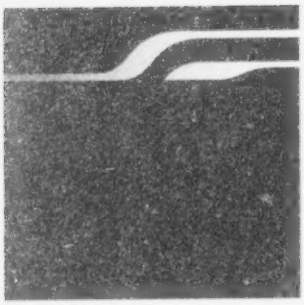


survive from the root for over 75 years. Russian knapweed is known to infest many areas that border the South Saskatchewan River and is considered to be Saskatchewan's most common knapweed.

Centaurea maculosa
(Spotted Knapweed)

Spotted knapweed is an erect short-lived perennial or biennial that reproduces only by seed. It grows up to 122 cm (48 inches) tall and its leaves and stems are similar to that of Russian knapweed in its grey-green color. The basal leaves (those at the bottom of the plant) are several times divided and grow in a direction which resembles a spider-web. As the leaves get closer to the top of the plant they are smaller and less divided. The flowers of spotted knapweed grow at the tips of the branches and are usually pink or purple in color, but may also be white. The egg-shaped to oblong flower buds are surrounded by stiff, black-tipped bracts or scales, giving the flower head a spotted or netted appearance. Spotted knapweed flowers in late June to early August and from a distance it can easily be mistaken for Canada thistle. In Saskatchewan, spotted knapweed has been found in the Maple Creek, Rockglen, and Chaplin areas as well as two sites in the city of Regina. It is adapted to the dark brown soil zones of Saskatchewan and Alberta.

Centaurea diffusa
(Diffuse Knapweed)

Diffuse knapweed can act as an annual, biennial, and short-lived perennial reproducing only by seed. It has a structure very similar to that of spotted knapweed. Its erect stems grow up to 81 cm (32 inches) tall, are highly branched, and are a dull, greyish-green in color. Similar to spotted knapweed, the lower leaves are twice divided resembling a spider-web, only with the lobes being finer and more closely spaced than spotted knapweed. The flowers are numerous, and usually a creamy white color (sometimes pink or purple), with urn-shaped heads. Diffuse knapweed has a sharp spine 0.6-0.8 cm (1/4 to 1/3 inches) long with several pairs of lateral spines. The spine is typically straw coloured but may be darker on coloured flower types. Diffuse knapweed is adapted more to the brown soil zone.

Centaurea solstitialis
(Yellow starthistle)

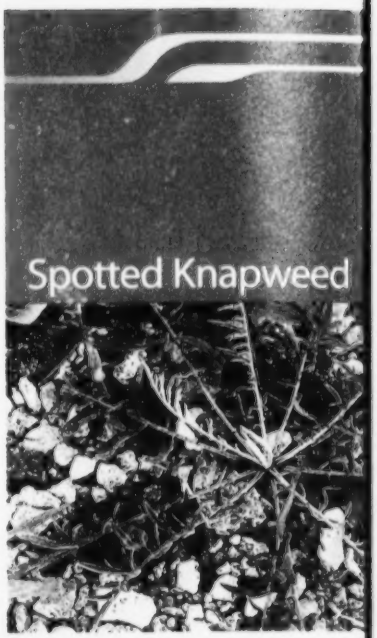
Yellow starthistle is a winter annual plant which reproduces only by seed. It has erect, multi branched stems that range from 91-183 cm (three to six feet) tall. The stems have a winged appearance as a result of the fusion of the stem leaves to the stem. The entire plant is covered in a cottony hair giving the plant a ghostly grey appearance. Fall rosettes of Yellow starthistle resemble hairy dandelions, with deep divisions in the leaves resulting in triangular lobes that are covered with hairs of various lengths. Flower buds have the same basic structure as other knapweeds, but the flowers are a deep yellow and the bracts have long, straw coloured spines up to two inches long that are flanked by two to six smaller spines. There are no documented sightings of Yellow starthistle in Saskatchewan as of yet, but it is still considered to be a threat and should be watched for.

The Problem

Native prairie is a part of our natural heritage and important as a grazing resource, wildlife habitat, and for soil and water conservation. Threats like the invasion of exotic species can degrade our prairie ecosystem by excluding native species, which reduces biodiversity, carrying capacity, habitat, and the aesthetics of our prairie ecosystem.

Knapweeds have many characteristics that make them a threat to native grassland:

- **They impair wildlife habitat and decrease plant diversity**
- **They decrease the visual quality of recreational lands**
- **They can become a 100 percent composition stand with minimal understory cover.**
- **They increase soil erosion rates. Stands of knapweed can exclude other plants from the patch that would otherwise stabilize the soil profile by developing fibrous root systems at several levels. Knapweeds are not effective groundcover, nor are they effective at stabilizing soil layers as do native plants, therefore leaving the soil prone to erosion.**



- **Knapweed can germinate in the spring or the fall under a wide range of soil and temperature conditions.**
- **They produce a large number of seeds which can remain viable in the soil for at least eight years after burial. Russian knapweed produces approximately 50-500 seeds/shoot, spotted knapweed produces at least 400 seeds/flower, diffuse knapweed produces about 1200 seeds/flower, and yellow starthistle can produce around 35-80 seeds/flower.**
- **Knapweeds are unpalatable to cattle and have only seasonal forage value for big game and sheep, resulting in animals grazing around infestations and opening up prairie for further invasion. Many knapweeds give off allelopathic compounds that suppress the growth of other plants, further enhancing their invasiveness. Russian knapweed and yellow starthistle contain a compound called repin that causes a neurological disorder in horses called nigropallidal encephalomalacia or "chewing disease".**

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Control

While Russian knapweed has been in the province for some time and spotted knapweed has been found in the last couple of years, these knapweeds as well as the others are still at reasonably low levels. However, there is still an opportunity for new infestations which require aggressive treatments to prevent the further encroachment of these persistent, non-native plants into Saskatchewan.

1. Awareness

People have been the major cause of the spread of knapweeds (i.e. clothing, vehicles). Informing the public of knapweeds will increase awareness of the threats of these weeds. Becoming aware and alerting others to the problem will encourage quick and direct action to prevent further introduction and spread.

2. Prevention

Probably the most efficient way to control knapweeds is through prevention. Identification is essential. Know what knapweeds look like and become familiar with their characteristics. The most effective method of control is early detection and removal. Since knapweeds thrive on disturbed sites, watch for them in areas such as pastures, roadsides and streambanks, as well as hay feeding spots. Detection and control of a few plants now will be much more cost effective as compared to dealing with a larger acreage later.

Other methods of prevention include exercising caution when purchasing hay from infested states, provinces, or areas; as well as managing pasture areas to prevent overgrazing. Knapweed seeds attach easily to pant cuffs, shoelaces, and the undercarriage of vehicles. Therefore, caution should be taken when visiting infested areas, that the seeds are not transported from your shoes or vehicle.

3. Monitoring

Noxious weeds cannot be prevented if we are not looking for them. Monitoring infested sites as well as potential new sites (disturbed sites) is a key component to keeping knapweed under control. Keep an eye out for knapweed plants in your pastures as well as surrounding area. Consistent monitoring now will solve many problems that may occur in the future.

Management Techniques

Due to the longevity of their seeds, eradication of established knapweed stands is often difficult. Stress and the prevention of seed production is the key to successful control and management. It should also be noted that often, the use of just one management technique will not effectively control the plant. A combination of techniques, such as chemical and cultural methods, proves to be the most successful. This is known as integrated weed management.

Hand Pulling

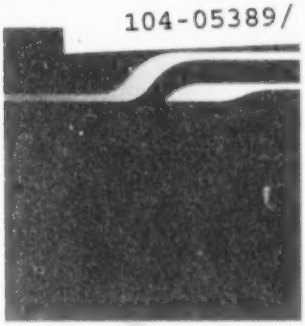
Hand pulling or picking can often be effective in eliminating single plants or small groups of plants. It is labour intensive to pull a large area infested with knapweed. If the soil has been severely disturbed, this may not be a reliable method of control, as it just encourages other infestations. If hand pulling is to be an option, it is important that the entire root of the weed is removed with the rest of the plant. Pulling is not a viable option for Russian knapweed because of its deep, persistent root system.

Mowing

Mowing may be a temporary option to control seed production and prevent spread, but very rarely will it cause eradication. If mowing is used as a management method, it should occur just after flowering but before the seed matures. Mowing after the seed is viable only contributes to the spread of the knapweed. Mowing will need to be repeated later in the season in order to be effective in preventing seed production. Short term evidence has shown that Russian knapweed, which is slightly less aggressive, may be successfully controlled through mowing if done twice per year for several years, but there is still no significant evidence that this will work as a method of control in the long run.

Grazing

Grazing is not a recommended control measure for knapweeds other than the rosettes of yellow starthistle. Knapweed provides very little forage value to livestock; therefore it may be difficult to get them to graze it. The best way to use grazing as a control method is to prevent overgrazing and ensure proper grazing distribution. Both overgrazing and uneven grazing can cause bareground patches that can lead to dry, eroded conditions which provide an ideal site for knapweed establishment.



Fire

Fire is not a recommended method of management for controlling or preventing the establishment of knapweed, as knapweed does not burn easily.

Chemical Control

There are many different herbicides that have been used in the control of knapweed, some successful, others less so. Refer to the Guide to Crop Protection published annually by Saskatchewan Agriculture, Food, and Rural Revitalization for application rates and procedures. The most successful ones are as follows:

1. Russian Knapweed

Picloram (Tordon 22K) if applied at the correct rate will give good control for at least two years. Dicamba (Banvel) and 2,4-D will give topgrowth control but will not control the persistent root. Caution should be exercised when planning to use Picloram since it is very persistent and water soluble and should not be applied to permeable soils or irrigated areas. DyCleer is another chemical that has been recommended and should be applied when the leaves are fully expanded in order to be effective.

2. Spotted Knapweed

Picloram (Tordon 22K, Grazon) and Clopyralid (Lontrel) are the most commonly and effectively used chemicals for spotted

knapweed control. Dicamba has also shown decent activity on spotted knapweed when applied at the correct rate and timing. Picloram causes the largest initial decrease in native species but over the long-term still shows benefits from the release of spotted knapweed competition. 2,4-D can be used as a method of suppressing spotted knapweed if applied when the plant is in the rosette stage. Unfortunately this is not always effective as 2, 4-D does not inhibit germination of the seeds in the soil. Dicamba and 2, 4-D treatments will need to be repeated often as there is no continued residue activity.

3. Diffuse Knapweed

Diffuse knapweed seems to be best controlled with 2, 4-D or Glyphosate, although this only provides seasonal control. If longer control (approximately two or more seasons) is desired, then Dicamba (Banvel) and Picloram would be the best options when applied to actively growing weeds. Dycleer can also be used if applied when the leaves are fully expanded.

Biological Control

Several insects have been released in North America to control the spread of the different types of knapweed. Only Russian knapweed is present in sufficient numbers to make a biological control program feasible. A gall nemotode *(Subanguina picridis)* is available for Russian knapweed but control levels have not yet been determined. There have been various agents introduced into the United States for the control of spotted and diffuse knapweed, but little research has been done in Canada to determine if these agents are adaptable to our conditions. Control strategies for these less common knapweeds should instead focus on locating new stands and preventing their spread through other management methods.

Other Methods of Control

A very effective method of controlling knapweed is by stressing the weed (for example, with the application of chemicals) and then reseeding the area to a competitive perennial grass species. This should only be an option if knapweed has infected tame pastures or cropland, as it is not recommended to break native grasslands. It should be noted though, that the reintroduction of grasses may be difficult due to the build-up of allelopathic chemicals in the top layer of soil and tillage may be required in order to disperse the allelochemicals through the soil to allow germination of new grasses. If chosen to do so, sod-forming grasses help prevent invasion better than bunchgrasses. If a native pasture has been infested and the knapweed stand is not too old and well-established, growth of the native grass species may be stimulated by irrigation (if possible). This may increase the competition of the grass therefore keeping the weed under stress. Using irrigation is also a method that could apply to tame pastures if one does not wish to reseed.

Summary

Knapweeds are an extremely aggressive species with the potential to rapidly invade native grasslands, thus threatening the diversity of native habitat. Awareness of this weed needs to be raised and the expansion of the weed in Saskatchewan prevented. Management of knapweeds must include an integrated approach using numerous methods of control and monitoring, with the main focus being prevention.

For Further Information

A bibliography of the resources used to prepare this factsheet is available from the Saskatchewan Watershed Authority. Factsheets on other species and topics are also available.

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